Original scientific paper

UDC: 377.8

Received: May 07, 2025.
Revised: July 24, 2025.
Accepted: August 02, 2025..

10.23947/2334-8496-2025-13-2-241-255

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Impact of Perceived Research-Based Teacher Education on the Perceived Research Competence of Pre-Service Teachers

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Abstract: This study examines the impact of perceived research-based teacher education on the development of pre-service teachers' perceived research competence. A new instrument was developed to measure perceived research-based teacher education at the programme level, capturing aspects such as participation in faculty-led research projects, opportunities for dissemination of results and involvement in the institutional research culture. The data were collected from 234 master's students enrolled in Slovenian teacher education programmes. Participants completed a questionnaire that assessed both perceived research-based teacher education and three dimensions of perceived research competence: perceived research knowledge, perceived research skills and research attitudes. The results showed that pre-service teachers perceive a moderate presence of perceived research-based teacher education in their study programmes and a moderate level of perceived research competence. Furthermore, regression analyses revealed a significant relationship between perceived research-based teacher education and all three components of perceived research competence, with the largest effect observed for perceived research skills. These findings show the potential of systematic, institution-wide support for research experiences in teacher education, including collaborative projects, faculty and student research efforts, and opportunities to apply and present research findings. By strengthening the elements of research-based teacher education, programmes can help pre-service teachers develop the knowledge, skills and attitudes necessary for evidence-based practice.

Keywords: *perceived research-based teacher education, pre-service teachers, perceived research competence, evidence-based practice, educational research.*

Introduction

The teaching profession is undergoing important changes, where researchers are increasingly emphasising the importance of a research-based teacher education where the aim is to educate pre-service teachers to be reflective, evidence-informed professionals capable of adapting to rapidly changing classroom tasks (Brew and Saunders, 2020; Matjašič and Vogrinc, 2025a; Munthe and Rogne, 2015). In countries known for high educational achievement (e.g., Finland), research-based teacher education is a key feature of teacher education and is often associated with success in student knowledge assessments. Finnish teacher education, for example, requires all pre-service teachers to have a master's degree that includes in-depth research practice. This means that pre-service teachers familiarise themselves with scientific research, write research-based texts and take special courses on research methodology. In addition, they carry out their own research projects for their bachelor's and master's theses, apply scientific methods and gain insights into data collection methods, systematic analytical thinking, interpretation and evaluation (Jakhelln et al., 2019). According to Krokfors et al. (2011), there are four main features of research-based teacher education: (1) the study programme is structured according to a systematic analysis of education; (2) teaching is based on research; (3) pre-service teachers engage in activities that foster argumentation, decision-making, and justification in investigating educational problems; and (4) pre-service teachers improve their research skills as part of their studies. The underlying idea is that

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pre-service teachers learn to view teaching as an evidence-based profession from the beginning of their education. In Slovenia, academics have similarly emphasised the role of the teacher as researcher. For example, Krek and Vogrinc (2007) discuss the concept of the "teacher-researcher of educational practice" and argue that teachers should acquire the ability to systematically investigate their own and others' educational practice during their education. By positioning pre-service teachers as producers and consumers of research, research-based teacher education aims to professionalise teaching in line with other research-based areas and improve the overall quality of education.

Within research-based teacher education, research competence is the main concept that enables pre-service teachers to critically engage with educational research, conduct their own investigations and apply research findings to improve their teaching practice (Agud and Ion, 2019; Matjašič and Vogrinc, 2025a). Research competence is usually conceptualised as comprising three interlinked dimensions: research knowledge, research skills and research attitudes (Matjašič and Vogrinc, 2024). Pre-service teachers who can understand research findings, conduct research (e.g., small-scale research projects) and make data-informed decisions are better equipped to improve their learning and be innovative in their future teaching. This perspective builds on the concept of "teacher as researcher" (Stenhouse, 1975), which positions practicing teachers as central agents in curriculum development through classroom inquiry and collaboration with academic researchers. Later scholars, such as Krek and Vogrinc (2007) and Saqipi and Vogrinc (2016, 2020), extended this concept to pre-service teachers, emphasising the idea that pre-service teachers should proactively investigate and reflect on their practice to promote continuous improvement. Aligning teacher education with this vision means that pre-service teachers are not just passive recipients of knowledge, but are actively involved in the creation and evaluation of knowledge, particularly through the investigation of their experiences in classroom practice. In turn, the development of research competence during teacher education is seen as crucial for educating pre-service teachers who can bridge the gap between theory and practice (Magnaye, 2022; Matjašič and Vogrinc, 2025a). As highlighted by Toom et al. (2010), educational reforms and professional development initiatives increasingly emphasise the integration of research processes into teacher education, highlighting that a research-based teacher education fosters the reflective, inquiry-oriented mindset necessary for continuous professional development. The ability to engage with research is now recognised as one of the most important competences for pre-service teachers and is influencing policy and curriculum design in teacher education around the world (Aspfors and Eklund, 2017; van Katwijk et al., 2019). With this in mind, investigating the impact of research-based teacher education on pre-service teachers' research competence is both timely and important to understand how such education shapes the next generation of teachers.

Theoretical Framework

Research-based teacher education

Several theoretical frameworks explain why and how integrating research into teacher education is important. One perspective cited by many authors (e.g., Rutten and Wolkenhauer, 2024; van Katwijk et al., 2021) is the concept of teacher "inquiry as stance", defined as a way of looking, acting, and having a habitual, continuous attitude (Cochran-Smith and Lytle, 2009). Engaging in systematic inquiry is not just an activity for pre-service teachers, but a professional stance that pre-service teachers carry into their careers, characterised by continuous questioning, reflection, and investigation into teaching and learning. Rather than treating research as an add-on, the inquiry stance concept embeds research-mindedness into teachers' professional identity (Cochran-Smith and Demers, 2010). When teachers take an inquiry stance, they act as reflective practitioners (Schön, 1983), pose questions or "wonderings", collecting data to gain insights into their wonderings, analysing the data along with reading relevant literature, making changes in practice based on new understandings developed during inquiry, and sharing findings with others (Dana and Yendol-Hoppey, 2014, p. 12). Teachers with an inquiry stance view their classrooms as spaces for ongoing learning as they formulate questions about their practice, collect and analyse data and use evidence to guide improvements. Cochran-Smith and Lytle (2009) argue that such a stance empowers teachers to be individuals of change in their own classrooms and schools, fostering a mindset of lifelong learning. This aligns with broader notions of teachers as reflective practitioners (Schön, 1983). Schön (1983) argues that the act of reflection in teaching is not simply a retrospective process that happens once

a lesson or task is completed, but an ongoing process that occurs in the middle of the action. By positioning inquiry at the heart of teaching, these perspectives provide a powerful rationale for research-based teacher education: if we want pre-service teachers to be inquiring professionals, teacher education must cultivate that disposition from the start.

The recognition that research-based teacher education contributes to better educational outcomes has also been emphasised by the European Commission and the Organisation for Economic Co-operation and Development (OECD), which advocate greater integration of research into teacher education. Both organisations emphasise the need for pre-service teachers to develop the skills and dispositions required to engage with research during their education (European Commission, 2015; OECD, 2023). Recent OECD analyses (OECD, 2023) particularly emphasise that pre-service teachers benefit from a systematic approach to research-based teaching, opportunities for critical questioning and regular practice in reflecting on and adapting their teaching strategies. Furthermore, the European Commission (2015) suggests that in order to achieve a creative and reflective teaching workforce, policies and actions should encourage pre-service teachers to utilise and engage with new research findings in their learning and practice.

The aim of research-based teacher education is pedagogically-thinking, reflective and inquiry-oriented teachers (Toom et al., 2010). This means that the purpose is not to educate researchers or even teacher-researchers per se. The objective is to acquire an inquiring attitude to teaching. Thus, pre-service teachers are able to observe, analyse and develop their work. Teachers' pedagogical thinking means the ability to conceptualise everyday phenomena, to look at them as part of a larger instructional process and to justify decisions and actions made during this process (Toom et al., 2010). In essence, a research-based teacher education aims to integrate the education of pre-service teachers with the processes of knowledge generation, fostering an inquiry as stance (i.e., a disposition to question and investigate classroom practice). Several conceptual models delineate forms of research integration in teaching. For example, Griffiths (2004) identified four modalities of linking research and teaching in higher education: research-led (curriculum driven by teacher-researchers' interests), research-oriented (emphasising learning inquiry skills and understanding research processes), research-based (curriculum organised around research activities rather than just content acquisition), and research-informed (drawing on existing research about teaching and learning). According to Štemberger (2020), all four modalities are valid, and they should all be present in research-based teacher education. In general, research-based teacher education means that pre-service teachers carry out research in their courses independently and with an open outcome, thus enabling them to internalise and practice research approaches and methods, including the skills of formulating precise questions and processing and monitoring the research process (Štemberger, 2020).

Concrete frameworks for implementing research-based teacher education have been proposed in policy and research. One prominent example is the British educational research association report (BERA and RSA, 2014), which outlined multiple dimensions of a research-based teacher education. According to this report, research can contribute to teacher education in at least four ways (1) informing the content of teacher education (ensuring curricula are built on up-to-date, research-based knowledge); (2) guiding the design and structure of programmes; (3) equipping pre-service teachers and educators to be discerning consumers of research; and (4) involving both teacher educators and pre-service teachers as active researchers, to investigate the impact of particular interventions or to explore the positive and negative effects of educational practice. These dimensions underscore that a research-based teacher education is not just about adding a research methods course or a thesis requirement, but cultivating an overall culture where research competence and research are interrelated throughout the coursework and field experiences. This holistic view is supported by Alvunger and Wahlström's (2018) study of Swedish teacher education, in which the authors argue that "education as a whole must be included in the concept of research-based education", meaning that every component of the programme (not just isolated research projects) should reflect scientific rigour and encourage critical examination. In summary, the theoretical foundation of research-based teacher education lies in the development of teachers who can think and act as research-based practitioners who connect theory and practice by using inquiry to continuously improve their teaching and their students' learning.

The implementation of research-based teacher education usually includes several important steps. First, research content is included across courses, for example, pre-service teachers learn how to read and interpret educational research, apply research findings to classroom challenges, and use data to inform decision-making. Second, pre-service teachers often carry out their own research (e.g., action

research projects) under the guidance of teacher educators who themselves exemplify scientific research. The aim of this guidance is not only the production of a thesis document, but to help pre-service teachers see themselves as researchers in their field. By engaging in research activities, pre-service teachers can develop a habit of questioning and investigating educational problems systematically, rather than relying on intuition alone (van Katwijk et al., 2023). Third, research-based teacher education implies that the curriculum and teacher education are research-based. In essence, research becomes both the content, and the means of teacher education where pre-service teachers learn about research, through research, and for the purpose of enhancing educational practice.

Research competence

The need for research-based teacher education goes hand in hand with an emphasis on the development of research competence. In the context of teacher education, research competence is the ability of pre-service teachers to understand and conduct research, critically evaluate findings and use research as a tool to improve their teaching practice (Matjašič and Vogrinc, 2024; Matjašič and Vogrinc, 2025a). This competence is not only about acquiring skills and knowledge related to research methods, but also about developing research-oriented teachers who are able to observe, analyse and develop their work. In other words, research-based teacher education should support the development of the knowledge, skills and attitudes that pre-service teachers need to become active, evidence-based practitioners. Moreover, for teachers to stay research-oriented, research must be trustworthy and practically useful for them. According to Westbroek et al. (2022) this means that teachers' new idea (comprising research problem and research questions) fit existing lesson goals, so it does not undermine what the class already has to achieve, that teachers have clear, step-by-step guidance (e.g., from other researchers) on how to apply the new idea in everyday lessons, and that putting it into practice adds a small amount of extra time or effort. According to Westbroek et al. (2022), the criteria of congruence, clear guidance and low cost translate the teacher as researcher concept into a daily micro-cycle in which teachers continually observe lessons, analyse emerging evidence and adjust their instruction, thereby embedding research activity in routine classroom decision-making.

Although much of the literature still relies on self-reports, we identified only two that explicitly compared perceived with actual (i.e., objectively assessed) research competence, and both found discrepancies. A study of Slovenian master's students (Matjašič and Vogrinc, 2025b) collected perceived and actual research competence at two time-points and showed that participants initially overestimated their actual research competence. This difference narrowed after the students took part in a research-based course but did not disappear entirely. Similar results were also observed in study by Böttcher-Oschmann et al. (2021), in which students initially overestimated their actual research competence, but the more they conducted research as part of their research-based projects their perceived research competence more closely matched their actual research competence. These studies show that if pre-service teachers overestimate their research competence, research-based preparation is even more crucial.

Recent studies have shown that research-based teacher education can improve students' perceived research competence. For example, Thiem et al. (2023) showed how participation in an entire research process led to significant improvements in various dimensions of perceived research competence. Their study found that students who actively participated in research-based learning reported higher self-assessments in terms of research review, methodological skills, reflection on research findings, communication and content knowledge. By using a quasi-experimental design with fixed-effects panel regression models, the authors were able to infer that these improvements were a direct result of the experience of the entire research process and not just a function of overall academic development. Furthermore, the study by Matjašič et al. (2023) showed that the integration of research-based teaching into teacher education is important because it increases perceived research competence, especially research attitudes, perceived research skills and perceived research knowledge, and thus can improve the quality of teacher education. These findings align with results from Böttcher-Oschmann et al. (2021), who found that involving pre-service teachers in research-learning projects develops their competencies for evidence-based practice. Specifically, structured and authentic research-learning environments improved students' abilities to systematically review literature, employ methodological strategies, and effectively communicate research outcomes. Practical implications from these studies suggest that teacher educa-

tion should include systematic and supported opportunities for students to engage directly in research processes to promote research competence and prepare pre-service teachers to confidently engage in evidence-based practice.

Despite the recognised importance of research-based teacher education and the acknowledged need to develop research competence, there are several important gaps in the literature. First, the measurement of research-based teacher education tends to focus on the extent to which research is used to inform teaching and how research is embedded in the course. However, there is still a lack of standardised instruments to measure research-based teacher education. Krokfors et al. (2011), for example, surveyed teacher educators on how they conceptualise and practice a research-based teacher education. While their work explores how research-based elements are integrated into the course (particularly in seminars and thesis-related assignments), it does not capture broader programme-level issues such as whether students have had the opportunity to interact with researchers, contribute to faculty-led investigations, or present their own research in a formal setting. A similar observation applies to the studies by Munthe and Rogne (2015) and Brew and Saunders (2020). Both studies highlight how differently teacher educators interpret and implement research-based initiatives in their courses and emphasise the diversity of rationales and teaching strategies used. Furthermore, Fiskum et al. (2025) point out that within research-based teacher education, there is still a lack of common understanding and consensus regarding what it means and how it should be organised. Therefore, we believe that for a better understanding of research-based teacher education we need information from all levels - from individual courses, from pre-service teachers, from teacher educators themselves and from the programme assessed not only by analysing course documents (Alvunger and Wahlström, 2018) or a curriculum analysis (Štemberger, 2020). Such a perspective can provide deeper insights into how research-based teacher education is systematically integrated and how effectively the programme supports a research-based culture. Furthermore, recent studies in teacher education (e.g., Afdal and Spernes, 2018; Alvunger and Wahlström, 2018) have shown the complexity of implementing research-based teacher education. Although these studies provide rich qualitative insights into the link between research and teaching (e.g., how teacher educators perceive the integration of teaching and research, what activities or strategies they use, and how they redesign their courses), they do not provide programme-level measures of research-based teacher education. Thus, there remains a need for instruments that can examine research-based teacher education beyond the level of a single course or research project and capture the multiple ways in which study programme can systematically encourage, support, and assess research engagement. Second, while several studies have investigated the development of pre-service teachers' perceived research competence through research-based course (e.g., Magnaye, 2022; Matjašič and Vogrinc, 2025a), we could not find any study that investigated the impact of perceived research-based teacher education at the programme level on pre-service teachers' perceived research competence. We argue that by analysing the impact at a programme level, it becomes possible to understand how perceived research-based teacher education practices contribute to the development of perceived research competence that extends beyond individual courses. Third, Štemberger (2020) examined teacher education curricula in Slovenia and found that more than half of the programmes do not explicitly include the acquisition of research competence as a stated goal. Study concludes that remains unclear to what extent the research elements are implemented in actual teaching practice. Accordingly, Štemberger (2020) emphasises the need for follow-up studies using alternative methods (e.g. questionnaires for pre-service teachers) to investigate how research is actually implemented and how pre-service teachers participate in research. Fourth, although it seems self-evident that embedding research tasks will automatically increase research competence, some studies report large increases in perceived research competence of students when they are engaged in research-based teaching (Thiem et al., 2023), whereas others find improvements only in specific domains (i.e., cognitive knowledge increased, but motivation decreased) after similar coursework (Gussen et al., 2023).

Research questions

Given these gaps, the present study aims to address two important issues. First, by developing a new instrument to measure perceived research-based teacher education, our study aims to provide a standardised instrument that can be used to evaluate and compare teacher education programmes and serve as a starting point for translation, adaptation and validation in other languages and contexts.

Second, by investigating the impact of perceived research-based teacher education on pre-service teachers' perceived research competence, the study not only tests whether the integration of research into the curriculum can increase pre-service teachers' perceived research competence but also how much does it increase.

Based on these gaps, the following research questions were answered:

RQ1: What is the level of perceived research-based teacher education and perceived research competence (i.e., perceived research knowledge, perceived research skills and attitudes) among students enrolled in master's programmes for pre-service teachers?

RQ2: What impact does the perceived research-based teacher education have on the perceived research competence (i.e., perceived research knowledge, perceived research skills and attitudes) of pre-service teachers?

Materials and Methods

Participants

The sample consisted of 234 master's students enrolled in teacher education at several Slovenian higher education institutions in the academic year 2023/2024 (Table 1). To check whether our sample was large enough after the data were collected (in order to answer RQ2), we ran a post hoc power analysis in R (package pwr). The procedure converts each observed coefficient of determination (R^2) into Cohen's f^2 and, using the non-central F distribution, estimates the probability of detecting an effect of that size at $\alpha = .05$. With N = 234 we had 99% power to detect the overall multivariate effect ($R^2 = .169$, $f^2 = 0.203$) and 88 % power for the smallest single-outcome effect ($R^2 = .098$). Both values exceed the conventional .80 benchmark, indicating that the study was adequately powered.

According to Slovenian regulations, primary and secondary school teachers must hold a master's degree, with several routes to obtaining a teaching qualification available. These include concurrent degree programmes offered primarily by pedagogical and multidisciplinary faculties (see Table 1), as well as consecutive degree programmes such as Pedagogical-Andragogical Education (PAE), which are designed for candidates with non-pedagogical degrees. Teachers (qualified for grades 1-5) study exclusively at faculties of education, while subject teachers (qualified for grades 6-9 and secondary education) study mainly at multidisciplinary faculties, where they acquire subject-specific knowledge as well as pedagogical skills and practical experience through school placements.

Table 1. *Participants*

University	Institution	N
University of Ljubljana	Faculty of Education	107
	Faculty of Arts	84
	Faculty of Chemistry and Chemical Technology	5
	Academy of Music	4
	Faculty of Theology	4
	Biotechnical Faculty	3
University of Maribor	Faculty of Education	13
University of Primorska	Faculty of Education	14

Instrument

Based on the literature review (Afdal and Spernes, 2018; Alvunger and Wahlström, 2018; Byman et al., 2009; Munthe and Rogne, 2015; Visser-Wijnveen et al., 2016), we developed 14 items, measured on a five-point Likert scale (1 - strongly disagree to 5 - strongly agree), measuring perceived research-based teacher education. To ensure content validity and clarity, the items were reviewed by a group of teacher education and curriculum development experts. Feedback from these experts was used to revise and refine the wording and content of the items. The revised instrument was then pilot tested with a sample of pre-service teachers. Minor adjustments were made based on the pilot data (i.e., one item was deleted, leaving the final set of 13 items).

To measure the perceived research competence, the questionnaire developed by Matjašič and

Vogrinc (2025a) was used. This questionnaire measures three key dimensions of perceived research competence: perceived research knowledge (15 items), perceived research skills (15 items) and research attitudes (15 items). Each dimension was measured on five-point Likert scale (1 - strongly disagree to 5 - strongly agree).

The questionnaire measuring both concepts was administered as a web-based survey. Students were informed of the aims of the study and assured that participation was entirely voluntary, with the right to withdraw at any time. They were also assured of complete anonymity and confidentiality. The data were securely stored, anonymised and analysed only in aggregate form to prevent identification of individual participants.

Analysis

All analyses were performed in R (R Core Team, 2022). To determine whether the factor structure of the perceived research competence questionnaire holds up, a confirmatory factor analysis (CFA) was conducted. The same was done for the items measuring perceived research-based teacher education. The confirmatory factor analyses were conducted using the lavaan package with the diagonally weighted least squares (DWLS) estimator for ordinal data. In addition, the item reliability analyses McDonald's omega (ω) and Cronbach's alpha (α) were calculated using the psych package. It should be noted that in addition to α, we have also calculated the ω because it provides a more robust estimate of internal consistency.

The CFA for the items measuring perceived research-based teacher education showed acceptable fit indices (CFI = .977, TLI = .972, RMSEA = .084, and SRMR = .073). These values fulfil the generally accepted thresholds for an acceptable model (Kline, 2016). In addition, all standardised factor loadings were significant ($p < .001$) and all were greater than .40 (Appendix A, Table A.1). Similar findings were observed for the items measuring perceived research competence (CFI = .952, TLI = .949, RMSEA = .066 and SRMR = .092) after excluding some standardised factor loadings that were less than .4 (see Appendix B, Tables B.1–B.3).

Once the factor structure and reliability of the scales had been confirmed, we first calculated the median and interquartile range (IQR) for the items measuring perceived research-based teacher education, due to violation of the assumption of normality as indicated by the Shapiro–Wilk test ($p < .05$ for all items). Because item-level descriptive statistics for perceived research competence have already been reported elsewhere (Matjašič and Vogrinc, 2025a), we did not replicate them here. Instead, we computed composite scores for each dimension of perceived research competence (perceived research knowledge, perceived research skills and attitudes) and perceived research-based teacher education by averaging the respective items. This allowed us to calculate descriptive statistics and assess the level of perceived research competence among students and also assess the impact of perceived research-based teacher education on pre-service teachers' perceived research competence using a multivariate multiple regression. We chose multivariate multiple regression because it accounts for the intercorrelations between the three dimensions of perceived research competence (knowledge-skills: r = .73, knowledge-attitude: r = .41, skills-attitude: r = .39), thus controlling for shared variance and reducing the risk of Type I error. As a Shapiro–Wilk test indicated deviations from normality for the composite perceived research knowledge ($W = 0.985$, $p = .013$) and the composite perceived research-based teacher education ($W = 0.987$, $p = .041$), we also used the Pillai's trace as a multivariate test statistic because it is robust to violations of normality (Olive et al., 2015). Univariate linear regressions were then performed to interpret the effects on each dimension, with bootstrapped confidence intervals (5,000 replicate samples) calculated for non-normally distributed outcomes. Standardised beta coefficients (β), 95% confidence intervals and effect sizes (η^2 and R^2) are provided to quantify the magnitude and practical significance of the relationships.

Results

We begin by presenting the descriptive statistics for the items measuring perceived research-based teacher education (Table 2).

Table 2. *Descriptive statistics for items measuring perceived research-based teacher education (n = 223), sorted from largest to smallest by median*

Item	Median	IQR
During my studies, I became acquainted with research conducted in my field of study.	4.00	2
During my studies, I had the opportunity to present the findings of my research work to my classmates.	4.00	2
During my studies, I had the opportunity to learn about the research work of my teachers and assistants.	4.00	1
The theory covered during our studies was supported by examples of specific research.	4.00	1
The faculty encourages international cooperation and the exchange of researchers from other countries.	4.00	1
During my studies, I had the opportunity to engage in discussions with researchers in the field of education.	3.00	2
During my studies, I had the opportunity to participate in student projects.	3.00	1
During my studies, I had the opportunity to write or contribute to writing a scientific or professional article.	3.00	2
During my studies, I had the opportunity to attend workshops, conferences, or seminars that emphasised the importance of research in the field of education.	3.00	2
During my studies, I conducted research independently or in collaboration with peers.	3.00	2
Teachers and assistants encouraged me to engage in research during my studies.	3.00	2
Scientific research work was an integral part of the study (e.g., familiarisation with research approaches, methods, and techniques characteristic of scientific research).	3.00	1
I am familiar with the research goals of the faculty.	2.00	1

From Table 2 we can observe that several items received relatively high median ratings (4.0), indicating that most students felt positively about certain aspects of perceived research-based teacher education. For example, many students reported being acquainted with research in their field of study and being taught theory supported by specific research examples. Students also indicated that they had the opportunity to present their research findings to classmates and learn about their teachers' and assistants' own research. Additionally, students perceived encouragement of international collaboration at the faculty level. On the other hand, the majority of items received median rating of 3.0 (items, such as participating in student projects, engaging in discussions with researchers, conducting research with peers, and writing or contributing to a scientific article) which suggests that while these experiences do occur, they may not be uniformly available to all students, given the relatively wide IQR values (1-2). Finally, the lowest rated item (median = 2) was students' familiarity with the faculty's research goals.

Next the descriptive statistics for the composite variables measuring perceived research-based teacher education and perceived research competence are presented (Table 3).

Table 3. *Descriptive statistics for composite variables*

Composite variable	N	Mean	Standard Deviation	Median	IQR	Shapiro–Wilk p
Research-based teacher education	223	3.26	0.65	3.23	0.79	.041
Knowledge	234	3.31	0.58	3.27	0.77	.013
Skills	230	3.50	0.58	3.52	0.67	.274
Attitudes	229	3.41	0.62	3.42	0.83	.227

Note: All composite variables represent perceived constructs

From Table 3, we can see neutral to moderate agreement between participants across the dimensions (median ≥ 3.23). The composite variable skills has a mean value of 3.50, indicating that on average, participants rated themselves as having a moderate level of research skills. Self-assessed understanding of research knowledge (median = 3.27) and attitudes (mean = 3.41) were also positive, but closer to neutral. On the other hand, the composite variable research-based teacher education had the lowest value (median = 3.23), which, although above neutral, suggests that participants feel that research-based practice could be emphasised more in curricula.

Finally a multivariate regression analysis was conducted to examine the extent to which perceived research-based teacher education impacts students' perceived research competence. The results are presented in Table 4.

Table 4. *Multivariate and univariate regression results predicting perceived research competence*

Outcome	β	SE	95% CI	p	R^2	V*
Knowledge	0.300	0.056	[0.165, 0.410]	< .001	.114	
Skills	0.304	0.053	[0.200, 0.408]	< .001	.127	.169
Attitudes	0.293	0.060	[0.175, 0.411]	< .001	.098	

Note: Predictor = perceived research-based teacher education, β = standardised coefficient; SE = standard error; CI = 95 % bias-corrected bootstrap confidence interval, V = Pillai's trace multivariate test (V = .169, F(3, 219) = 14.86, p < .001, η^2 = .17).

A multivariate regression analysis using the Pillai's trace revealed (Table 4) that perceived research-based teacher education significantly predicted pre-service teachers' perceived research competence (V = .169, p < .001). The results show that 16.9% of the variance in the multivariate outcome set (perceived research knowledge, perceived research skills, and attitudes) of perceived research competence is explained by perceived research-based teacher education. In addition, univariate linear regressions showed positive impact of perceived research-based teacher education on perceived knowledge (β = 0.300, p < .001), perceived skills (β = 0.304, p < .001), and attitudes (β = 0.293, p < .001), with the predictor explaining 9.8% to 12.7% of the variance in the results. We can also see that the standardised regression coefficient (β) is highest for the dependent variable skills (β = 0.304), followed by knowledge (β = 0.300) and attitude (β = 0.293). This indicates that perceived research-based teacher education has the strongest effect on the pre-service teachers' perceived research skills, followed by their perceived research knowledge and attitudes.

Discussion

This study investigated the relationship between perceived research-based teacher education and the perceived research competence of pre-service teachers. By developing an instrument to measure perceived research-based teacher education at programme level and analysing data from Slovenia, the results provide insights into the ways in which the integration of research into teacher education impacts the development of perceived research knowledge, perceived research skills and attitudes. Below we discuss the main findings, their implications, limitations and directions for future research.

First, by developing an instrument to measure perceived research-based teacher education at the programme level, we have addressed a gap in the existing literature (Afdal and Spernes, 2018; Ciraso-Calí et al., 2022; Fiskum et al., 2025; Munthe and Rogne, 2015), in which studies often focus on specific courses or master's theses and neglect broader programme factors, such as opportunities for students to engage in faculty-led research (e.g., "Teachers and assistants encouraged me to engage in research"), participate in collaborative projects, disseminate results (e.g., "present findings to classmates" or "write scientific articles"), and interact with the institutional research culture (e.g., "learn about faculty research goals« or "attend conferences"). By capturing these factors, our instrument provides a tool for measuring and evaluating curricula. For example, institutions that score poorly on "opportunities to engage in discussions with researchers in the field of education" or "opportunities to participate in student projects" could prioritise research symposia for students to foster a culture of inquiry and collegial learning, which is particularly important given the OECD (2023) recommendations for structured research integration in teacher education to improve pedagogical adaptability. Moreover, results from our study highlight that although research-based teacher education is integrated into the programme, the extent of student engagement differs widely. Some elements like connecting theory to current research are perceived to be well-established, whereas opportunities for deeper involvement in ongoing faculty research or clarity about broader research goals appear less consistent. This discrepancy may stem from variations in departmental resources, differences in faculty workloads, or uneven visibility of research initiatives.

Second, the moderate level of perceived research competence and perceived research-based teacher education observed in our study is additionally supported by the analysis of Štemberger (2020), who found that more than half of Slovenian teacher education programmes do not have explicit curricular goals related to research competence and that Slovenian institutions seem to prioritise research in isolated components (e.g., theses) rather than fostering a research-based culture of inquiry. The findings of the current study therefore highlight the need for systematic alignment between institutional policy, programme design and pedagogical practice. For Slovenian institutions, this could mean adopting the

BERA and RSA (2014) multidimensional model, which emphasises research-based curriculum design, modelling of scientific research by pre-service teachers and active participation of pre-service teachers in knowledge production. For example, pre-service teachers would be required to analyse peer-reviewed studies and design a small research project to test a strategy in the classroom, or teacher educators could present their research and involve pre-service teachers in data collection/analysis (e.g., coding interview transcripts). In this way, pre-service teachers would view research as a collaborative, iterative process rather than a solitary final project. Agud and Ion (2019) pointed out similar concerns at the Faculty of Education of the Universitat Autònoma de Barcelona and emphasised the need to redesign teacher education, because the traditional approach to educational research does not benefit teachers much. In their opinion, teacher education should focus on the effective implementation of a research-based approach to ensure a closer relationship between classroom reality and pedagogical theories and practices and to prepare pre-service teachers to integrate research into their future careers. Furthermore, Wæge and Haugaløkken (2013) have found that research on teacher education in many countries has shown that students view theory and practice in teacher education as incompatible or as part of different worlds. This can potentially have a negative impact on the pre-service teachers' opportunities for professional development, as such development should be based on the ability to view one's own teaching practice from a critical, theory- and research-based perspective.

Third, the findings of our study contribute to the growing body of literature that emphasises the role of research-based teacher education in promoting pre-service teachers' perceived research competence. The results suggest a significant positive relationship between perceived research-based teacher education and pre-service teachers' perceived research-related knowledge, skills, and attitudes. Specifically, perceived research-based teacher education explained 16.9% of the variance in perceived research knowledge, skills, and attitudes with the strongest effect observed for perceived research skills. These results are in line with the recent study by Bayrak Özmutlu (2022), which has shown that sustained research projects not only deepen pre-service teachers understanding of evidence-based practice, but also strengthen self-discipline, confidence and communication skills, outcomes that the author directly links to improved research competence. Furthermore, our results suggest that perceived research-based teacher education improves pre-service teachers' confidence in their ability to engage in research activities and that research activities and engagement during teacher education may be particularly effective in building the actual research skills required to conduct research. These findings support the notion that the model of the teacher as researcher (Stenhouse, 1975) can be effectively operationalised at a programme level, which is consistent with Cochran-Smith and Lytle's (2009) conceptualisation of "inquiry as stance" and results from study by Matjašič et al. (2023) who found that perceived research-based curricula significantly enhances pre-service teachers' self-assessed research knowledge, skills and attitudes, which is consistent with our findings. In addition, Thiem et al. (2023) found that conducting an entire research process improved students' self-assessed skills in terms of research review, methodology, reflection on research findings, communication, and content knowledge. Taken together, they concluded that the implementation of research-based learning pays off. The evidence from our study suggests that embedding research experiences throughout the study programme can enhance perceived pre-service teachers' research competence. However, further research is needed to deepen our knowledge of the effect of research-based teacher education on research competence.

Conclusions

Our study provides evidence that perceived research-based teacher education significantly increases pre-service teachers' perceived research competence, which extends to perceived research knowledge, perceived research skills and attitudes. Two practical implications can be derived from our findings. First, teacher education should consider adopting a systematic, institution-wide approach to research-based teacher education. This can be achieved by aligning institutional policies, curriculum design and educational practices to promote a sustainable research culture. For example, curricula could be enhanced by including activities that encourage active engagement with research, such as collaborative research projects (e.g., pre-service teachers have opportunities to participate in faculty-led research and collaborative projects which can help bridge theory and practice), research dissemination platforms (e.g., creating forums or symposia where pre-service teachers can present and discuss their research findings

may further cultivate an inquiry-oriented mindset) and integration of research in courses (embedding research elements in courses, rather than confining research experiences to specific modules or thesis work, can ensure that all pre-service teachers develop essential research skills and a critical, reflective stance toward their teaching practice). Second, the moderate levels of perceived research competence observed in our study suggest that current teacher education may benefit from revisiting and enhancing their research components. For example, teacher educators could be encouraged to model research practices in their teaching, thereby demonstrating the practical application of research in everyday classroom contexts. Institutions might also consider periodic curriculum reviews to ensure that research-based teacher education is not only present but effectively integrated and reflective of best practices as recommended by international standards. In doing so we can take the study by Wæge and Haugaløkken (2013) as an example. Their research demonstrated that a continuous interaction between theory and practice had a positive impact on the students' understanding of theory. The seminars (combining education science, subject didactics, and reflective discussions on classroom practice), arranged on a weekly basis throughout the semester, helped students to see connecting lines between theory and practice. These sessions enabled them to realise that theoretical knowledge offers practical strategies and insights that can be directly applied in the classroom.

Finally, it is important to acknowledge that our study has limitations. First, the use of self-reported, perceived measures of research-based teacher education and research competence introduces potential biases, such as social desirability or overestimation of ability. Although perceptions are critical to understanding pre-service teachers' confidence and preparedness, they may not fully align with objective abilities. Future studies should compare self-reports with performance-based assessments (e.g., ratings of research outcomes or knowledge tests) to validate these findings. Second, although the questionnaire has been tested for the Slovenian context, it has not yet been tested in other linguistic or cultural settings. For example, differences in institutional research culture or curriculum structures (e.g., the emphasis on action research in the Nordic models compared to other regions) could have an impact on how research-based teaching is perceived. Future research should validate and adapt the instrument in different linguistic and cultural contexts to confirm its cross-cultural applicability. Finally, longitudinal studies could clarify how sustained experiences with research-based teacher education impact pre-service teachers' perceived research skills, research knowledge, and attitudes during their education and in their professional careers.

Conflict of interests

The authors declare no conflict of interest.

Data Availability Statement

The derived data and the R code supporting the results of this study are available on request from the corresponding author. The data have been anonymised, but are not publicly available due to privacy issues.

Participant Consent Statement

All participants involved in this study consciously and voluntarily participated in the research.

Acknowledgements

The authors acknowledge the financial support of the Slovenian Research Agency under the research core funding Strategies for Education for Sustainable Development Applying Innovative Student-Centred Educational Approaches (ID: P5-0451).

Ethics Approval Statement

The study was conducted in accordance with the Declaration of Helsinki and was reviewed and approved by the Ethics Commission of the Faculty of Education of the University of Ljubljana. Approval code 14/2023, on 29 August 2023.

Author Contributions

Conceptualization, M.M., and J.V.; methodology, M.M., and J.V.; software, M.M.; formal analysis, M.M..; writing—original draft preparation, M.M.; writing—review and editing, M.M., and J.V; validation, M.M., and J.V. All authors have read and agreed to the published version of the manuscript.

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Appendix A

Table A.1. *Descriptive statistics, standardised factor loadings, McDonald's ω and Cronbach's α for items measuring perceived research-based teacher education*

Item	Standardised factor loading	ω (α)
During my studies, I became acquainted with research conducted in my field of study.	0.631	0.94 (0.86)
During my studies, I had the opportunity to present the findings of my research work to my classmates.	0.720	
During my studies, I had the opportunity to learn about the research work of my teachers and assistants.	0.705	
The theory covered during our studies was supported by examples of specific research.	0.626	
The faculty encourages international cooperation and the exchange of researchers from other countries.	0.585	
During my studies, I had the opportunity to engage in discussions with researchers in the field of education.	0.498	
During my studies, I had the opportunity to participate in student projects.	0.671	
During my studies, I had the opportunity to write or contribute to writing a scientific or professional article.	0.555	
During my studies, I had the opportunity to attend workshops, conferences, or seminars that emphasised the importance of research in the field of education.	0.603	
During my studies, I conducted research independently or in collaboration with peers.	0.562	
Teachers and assistants encouraged me to engage in research during my studies.	0.762	
Scientific research work was an integral part of the study (e.g., familiarisation with research approaches, methods, and techniques characteristic of scientific research).	0.661	
I am familiar with the research goals of the faculty.	0.474	

Appendix B

Table B.1. *Standardised factor loadings, McDonald's ω and Cronbach's α, for the dimension perceived research knowledge*

Item	Standardised factor loading	ω (α)
I know how to theoretically substantiate the research problem of my study.	0.650	0.95 (0.88)
I know how to formulate research objectives.	0.617	
I know how to formulate research questions.	0.555	
I know how to formulate hypotheses.	0.466	
I know how to choose the most appropriate research methodology for my work.	0.579	
I am familiar with different sampling methods or selection of individuals suitable for my research.	0.534	
I am familiar with the characteristics of different data collection instruments (e.g., questionnaire, knowledge test, interview question list).	0.587	
I am familiar with different methods of verifying the quality of data collection instruments (e.g., validity and reliability of the instrument).	0.542	
I am familiar with the fundamental ethical principles of educational research.	0.542	
I am familiar with the characteristics of quantitative research approaches.	0.581	
I am familiar with the characteristics of qualitative research approaches.	0.570	
I am familiar with the characteristics of quantitative data analysis.	0.700	
I am familiar with the characteristics of qualitative data analysis.	0.696	

Table B.2. *Standardised factor loadings, ω and α, for the dimension perceived research skills*

Item	Standardised factor loading	ω (α)
I know how to find the literature necessary for the theoretical background of my research	0.593	0.95 (0.91)
I know how to cite the literature I have read.	0.446	
I know how to summarise the essence of the literature I have read.	0.580	
I know how to design a research plan.	0.758	
I know how to explain the purpose of my research.	0.694	
I know how to create various instruments for data collection (e.g., questionnaire, knowledge test, interview question list).	0.650	
I know how to check the quality of the designed data collection instrument (their validity and reliability).	0.685	
I know how to use software for statistical data analysis (e.g., SPSS).	0.431	
I know how to write a report on an empirical research study.	0.679	
I know how to write a summary of an empirical research report (e.g., for a seminar paper).	0.731	
I know how to describe the data collection process.	0.683	
I know how to formulate conclusions of the research based on the collected data.	0.747	
I know how to write a statistical interpretation of the statistical procedures used.	0.626	
I know how to present the results and findings of my research to a broader audience (e.g., to my classmates, at a conference).	0.643	
I know how to develop a plan (an action plan) for implementing changes in educational practice based on the findings of empirical research.	0.477	

Table B.3. *Standardised factor loadings, McDonald's ω and Cronbach's α, for the dimension research attitude*

Item	Standardised factor loading	ω (α)
I enjoy reading research reports.	0.676	0.93 (0.87)
Knowledge of research in the field of education helps me succeed in my studies.	0.706	
Understanding research in the field of education helps me grasp the theoretical concepts discussed in various courses.	0.708	
I am interested in research in the field of education.	0.582	
It is important to me that my teachers and assistants conduct research.	0.627	
I find it important for a teacher to use examples from their own research in lectures.	0.549	
For effective teaching at university, it is important that teachers and assistants engage in research.	0.601	
Teachers' research in schools helps solve everyday practice problems.	0.555	
When I work in a school, I will engage in research activities.	0.591	
Conducting research is a good way to improve a teacher's teaching.	0.557	
Conducting research is a good way to enhance the prestige of the teaching profession.	0.631	
I feel part of the faculty's research community.	0.406	